The TCS Approach to NG9-1-1

October 4, 2011

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Contents

- About TCS

- Where does TCS fit?

- What are the realistic options for deploying NG9-1-1?

- How will we pay for it?

- Are regulatory changes required?

- What is a realistic timeframe?

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TCS Corporate Overview

Established in 1987

- **HQ: Annapolis, Maryland, USA**
- **Offices: MD, WA, CA, FL USA**
     Canada, India, China, Russia, UK
- **1,300+ employees**
- **$300M+ 2009 revenue**
- **NASDAQ: TSYS**

Strategic Offers

- **Messaging**
- **Location Infrastructure**
- **Navigation & LBS Applications**
- **Wireless, VoIP, & NG 9-1-1**
- **Telematics**
- **End-to-End Satellite Solutions**
- **Cybersecurity**

E9-1-1

QTL 9000
The Telecom Quality Measurement System

CERTIFIED
ISO 9001:2000
INTERTEK
CERTIFICATION

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Two Decades of Excellence

More than 20 years delivering mission-critical infrastructure and applications

Government				Commercial		
Deployable Comms Solutions	Global Satellite Services	Consulting & IT Services	Cyber Security	Location Solutions	Applications	Messaging

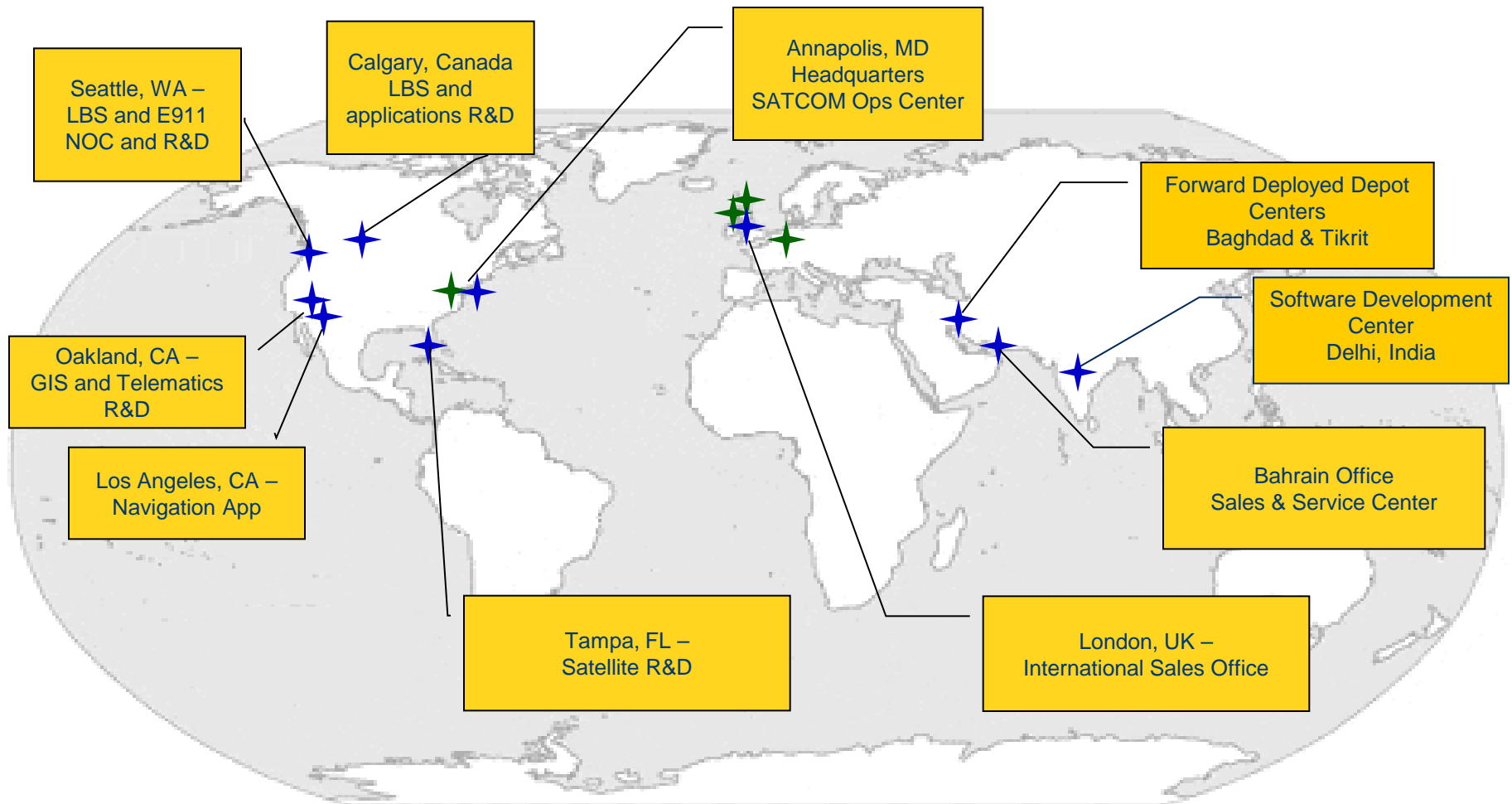|						
• Flyaway/VSAT • Wireless • Baseband IP • BGAN • Custom Secure Baseband IP Solutions	• Teleports • Co-Location Services • Gateways • Fixed Sites • Network Management	• COOP • Telecom Management • IT Services • Information Assurance • Maintenance	• Computer Exploitation Training • Biometric Solutions • Data Visualization	• Xypoint® Location Solutions • Reference Network • Assisted GPS • MPC/GMLC • Precise Hubs	• Navigation • Maps • Tracking • People Locator • Asset Locator • E9-1-1	• SMSC • Web Portal • IP Gateway • Wireless Intelligent Gateway

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TCS Facilities & Operations

Seattle, WA – LBS and E911 NOC and R&D

Calgary, Canada LBS and applications R&D

Annapolis, MD Headquarters SATCOM Ops Center

Forward Deployed Depot Centers Baghdad & Tikrit

Software Development Center Delhi, India

Oakland, CA – GIS and Telematics R&D

Los Angeles, CA – Navigation App

Bahrain Office Sales & Service Center

Tampa, FL – Satellite R&D

London, UK – International Sales Office

Teleports (Manassas, VA, Fuchstadt GE, Bedford UK, Chalfont Grove UK)

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Our Commitment to Quality

TCS uses ISO 9001:2000 Audited Development Processes

The ISO 9001:2000 quality management system emphasizes conformance to customer and applicable regulatory requirements while including processes for continuous improvement

TCS earned TL 9000 Certification

TL 9000 certification emphasizes a company's commitment to customer satisfaction, continuous improvement, and performance accountability

TCS is achieving ISO 27001 Certification

Certification obtained and an Information Security Management System (ISMS) deployed.

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E9-1-1 Wireless Carrier Excellence

TCS Market Leadership

- 57 operator networks worldwide
- Proven carrier grade high availability solutions
- Ranked #1 in US for Text Messaging*
- Ranked #2 globally for Location Infrastructure*
- Process half the wireless E9-1-1 calls in U.S.

Location & Public Safety

- Location Based Routing Platform
- Reference Network
- Assisted GPS
- Network & Handset based location
- Authenticated, Secure Services
- E9-1-1, VoIP 9-1-1, 9-1-1, Telematics

Messaging

- SMS Platform
- SMS Voting
- Wireless Gateway
- Web Portal
- Mobile Anti-spam
- Emergency Alerting /CMAS

*Frost & Sullivan Research

E9-1-1 Wireless Carrier Excellence

- **State-of-the-art chillers,**
- **HA Power Distribution**
- **N+1 resiliency**

- **Geo-Diverse**
- **Diverse Pathing**
- **Highly Redundant Systems**

TCS DATA CENTERS

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Government Customers

Air Force

Army

Special Operations

Coast Guard

DOD

FBI

GSA

Homeland Security

Marine Corps

Navy

Directorate of Info Mgt.

State Dept.

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Commercial Customers

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TCS 9-1-1 Presence

Carriers

- Contractual relationships with over **40 carriers**

- E9-1-1 services to over **100 million wireless** subscribers

- i2 compliant E9-1-1 services to over **4 million VoIP** subscribers

Public Safety

- Deployed E9-1-1 in 49 states plus the District of Columbia and Puerto Rico

- 4,122 PSAPs deployed for wireless E9-1-1 and the largest number of VoIP E9-1-1 PSAPs deployed: 5,066

- Member of NENA, APCO, E9-1-1 Institute, 911 Industry Alliance (9IA), ATIS, CTIA FCC CSRIC, ATIS, 3GP, EENA (EU), and others

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TCS 9-1-1 Service

- **Meets wireless E9-1-1 Phase I and Phase II FCC requirements**

- **Provides NENA VoIP i2 E9-1-1 service**

- **Geo-Spatial routing based on X/Y, MSAG , or USPS based addresses**

- **The only TL9000 certified NOC outside of a carrier environment provides 24x7x365 monitoring and support**

- **Operates 2 data centers that have provided 6+ years with 99.999% uptime**
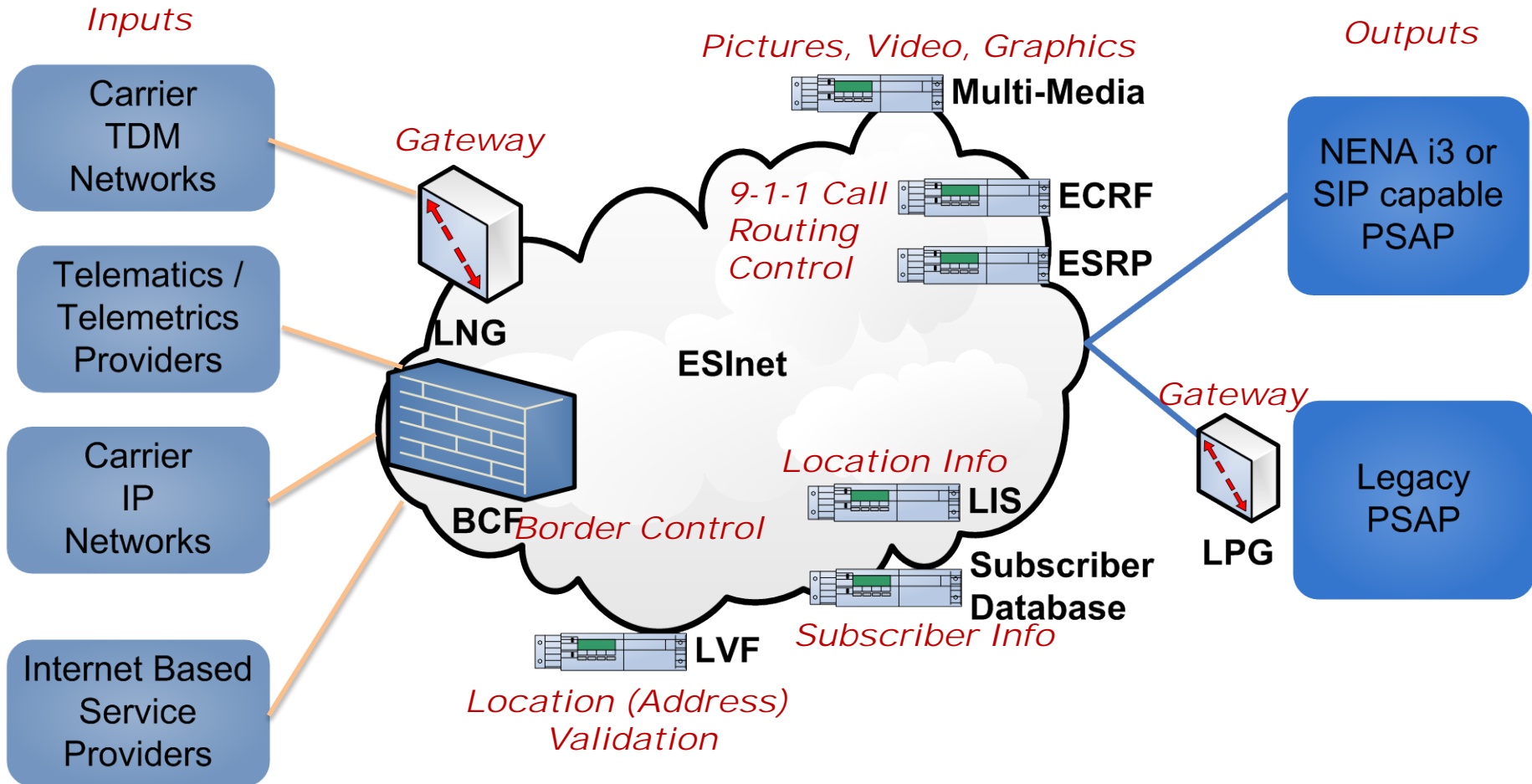
- **Routes over 150,000 E9-1-1 calls per day**

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NENA Environment: i3 Network Architecture
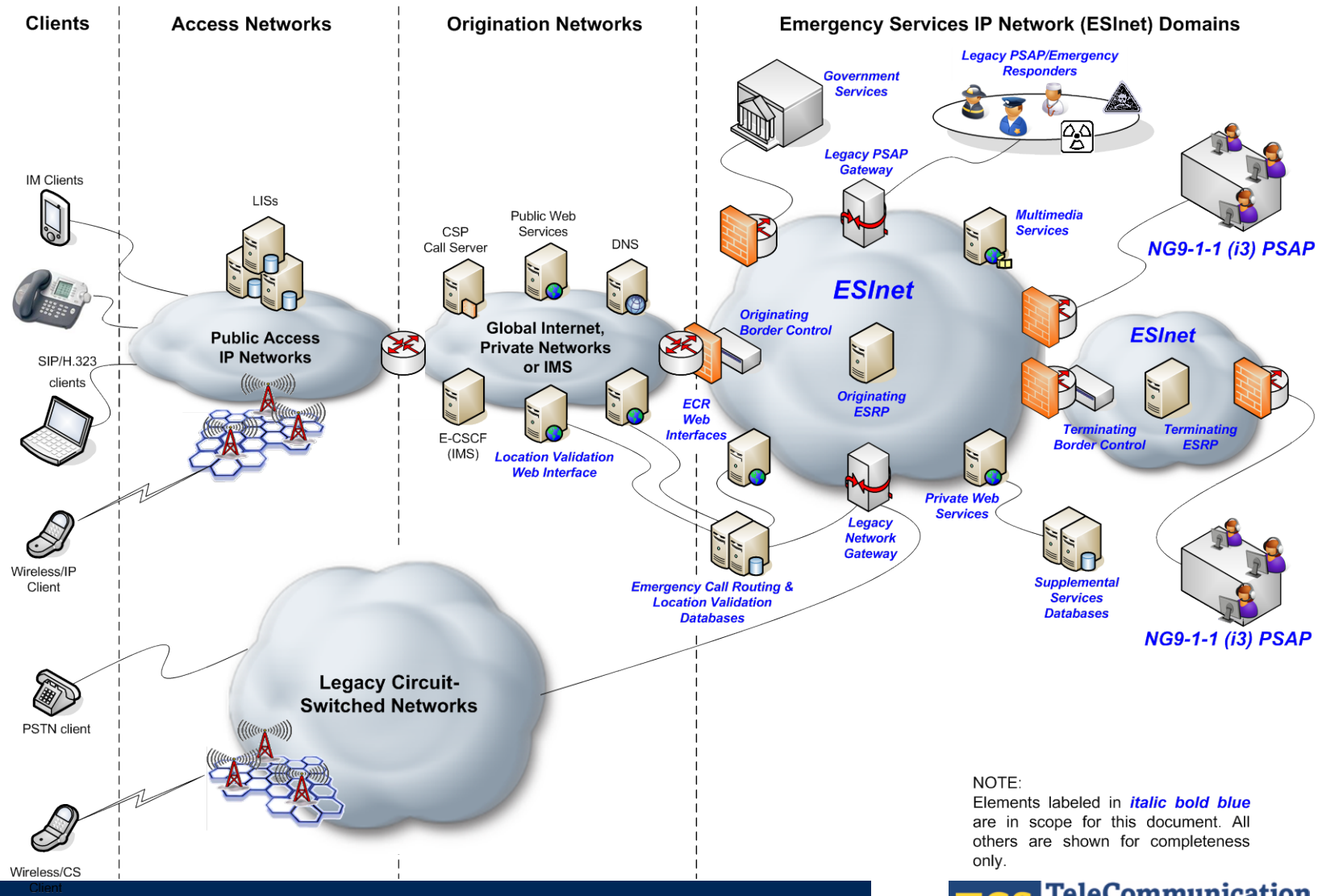
NENA i3 ESInet Elements…In English

Inputs

Carrier TDM Networks

Telematics / Telemetrics Providers

Carrier IP Networks

Internet Based Service Providers

Gateway

LNG

BCF *Border Control*

ESInet

Pictures, Video, Graphics
Multi-Media

9-1-1 Call Routing Control
ECRF
ESRP

Location Info
LIS

Subscriber Database
Subscriber Info

LVF
Location (Address) Validation

Outputs

NENA i3 or SIP capable PSAP

Gateway

LPG

Legacy PSAP

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Possible Deployment Strategies

Network Options:

- **MPLS**
- **Private Fiber**
- **Private Microwave**
- **CATV Broadband**
- **Wireless Broadband**
- **Local Exchange Carrier (ILEC)**
- **CLEC**
- **New Entrants**

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Possible Deployment Strategies

Individual PSAPs may connect directly to the National ESInet during the transition.
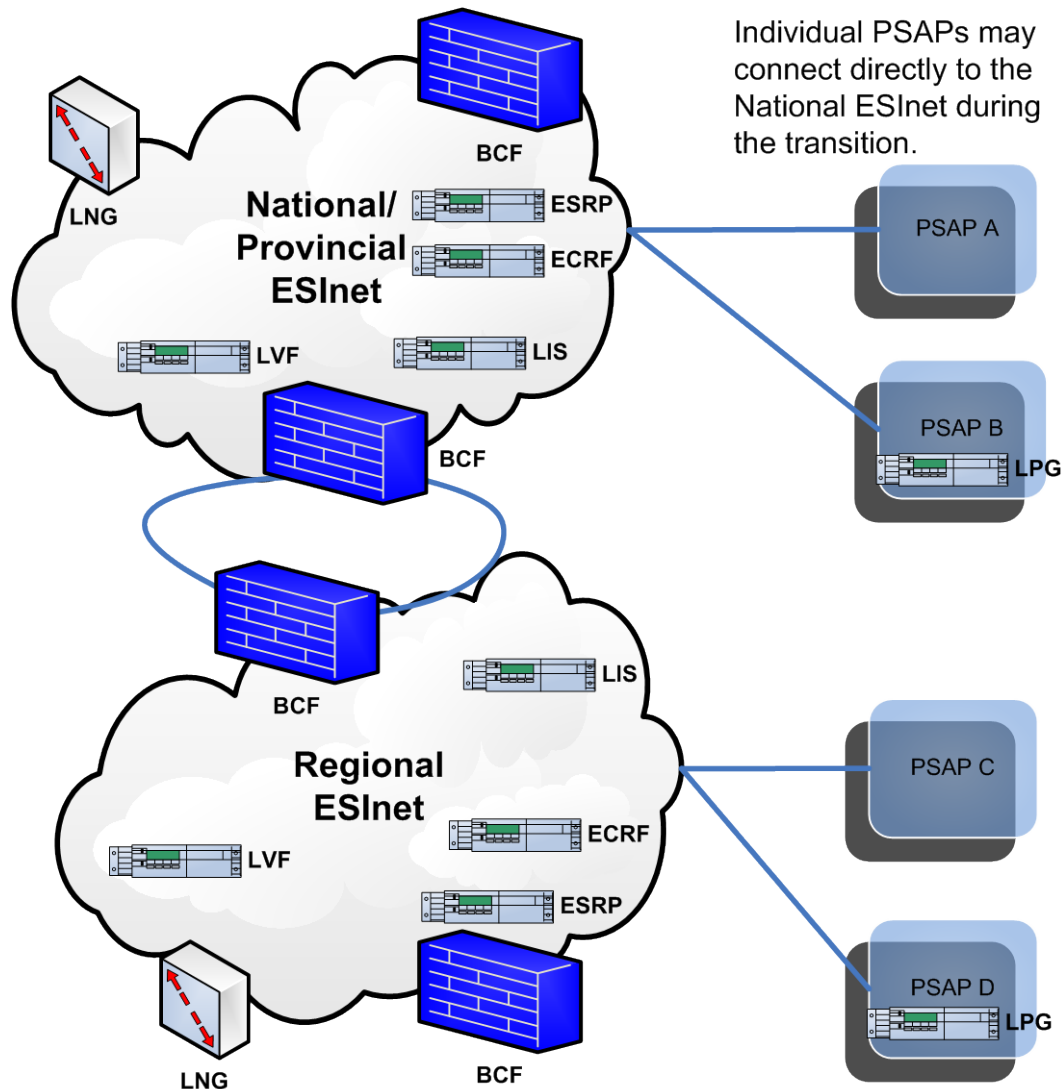
System Options

- **State/Regional ESInet initially**

- **NENA model enables a single, large ESInet to integrate with later established ESInets**

- **Systems hosted in local data centers, vendor data centers or third party co-location centers**

Deployment Recommendations
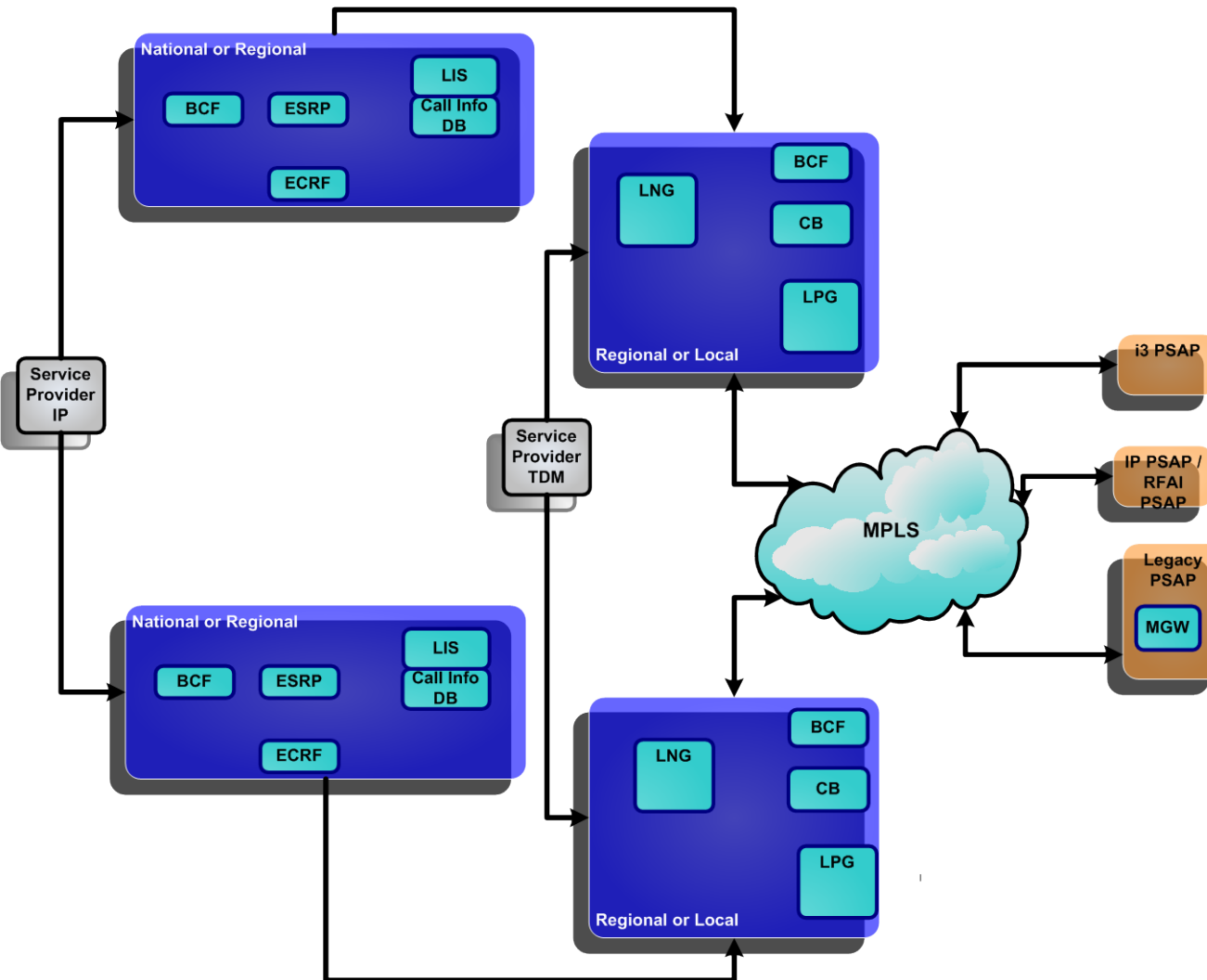
Desirable NG9-1-1 network features:

- **Geo-redundant and diverse components with local redundancy for most components.**

- **Voice media always stays local to reduce risk of network delays and failure**

- **Modular design enables placement of all data and signaling elements anywhere in the network**

Security Recommendations
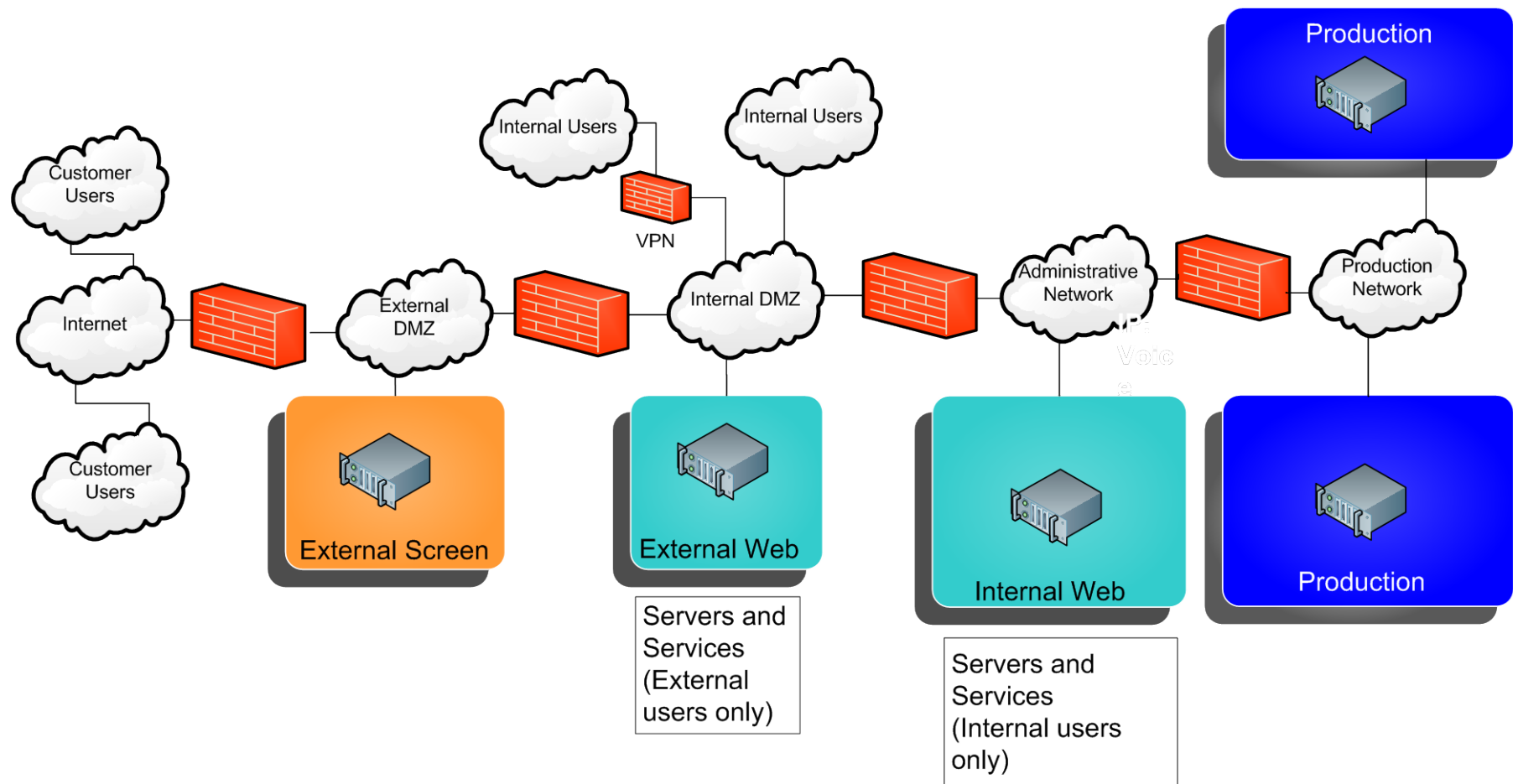
Multiple security zones protect customer data and production systems. **What is the vendor's level of Cyber Security expertise?**

Transition Fundamentals

- **CPE** needs to be able to accept additional data sources and communication technologies, e.g. IP-based voice and data.

- **GIS**, Address, and other data (Policy, Defaults, etc) that drive the system must be developed to a high standard of accuracy and integrity.

- **Routing** changes during transition must be methodical and easy to implement for Public Safety and Communications Service Providers.

Transition Options: PSAP CPE

- **Same CPE**, make them "Next Gen capable"
  - Network Router with media conversion capability converts incoming IP to serial communication where needed, supplying a part of NENA's Legacy PSAP Gateway (LPG) function
  - Add a web browser to bring files and IM into the PSAP using a pre-standard method
  - "IP capable" may not be enough!

- **New CPE**, built to i3 standards
  - More expense but change once
  - *Demand standards-based systems*
- **Hybrid,** if possible
  - Take advantage of PBX upgrades to accept incoming VoIP natively

Transition Options: Data

- **MSAG**
  - Use backwards compatible LVF (i3 term for DBMS) for all Communications Service Providers
  - Use a State GIS data source that can be distributed to multiple LVF providers
- **Subscriber/Location Database**
  - Use LIS and backwards compatible Subscriber Database (i3 terms for ALI) for all Communications Service Providers
  - Use LIS and as many Communications Service Provider ALI/LIS as necessary

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Transition Options: Routing

- **Call Routing - Phased Approach**
  - Start with ESInet for wireless and VoIP, use Selective Router(s) as concentrators for wireline
  - ESInet for all providers, utilizing Gateways as needed

- **Gradual Transition By:**
  - Service provider
 - Technology
  - PSAP
  - Geography

Transition FAQs

- **What happens to the 9-1-1 Selective Routers?**
  - Selective Routers/Tandems will likely stay in place during transition as concentration points. All calls from wireline central offices will flow through the Selective Routers to the ESInet.
  - Over time, as the LECs build new trunk groups to the ESInet, the SRs will be phased out. The timeframe may have to be negotiated with the 9-1-1 authority.
  - This may become a regulatory or contractual question in some places, especially where the E9-1-1 service provider is not the NG9-1-1 service provider.

Transition FAQs

- **What happens to the MSAG?**
  - NG9-1-1 uses a GIS system, incorporating the information from today's MSAG. This combined system, incorporating tabular MSAG info with spatial GIS info is able to route calls based on both civic addresses and geo coordinates.
  - You may hear it said that "there is no MSAG in NG9-1-1". While there is no tabular MSAG file like those used today, the information is incorporated in GIS form.
  - Before you buy, decide if you want to maintain control of that data or outsource it. A vendor's service model should include direct access to GIS/MSAG.

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Transition FAQs

- **Is the PSAP responsible for providing and maintaining GIS data?**
  - The PSAP authority may maintain the data directly or outsource the work. Either way, the authority is responsible for the content.
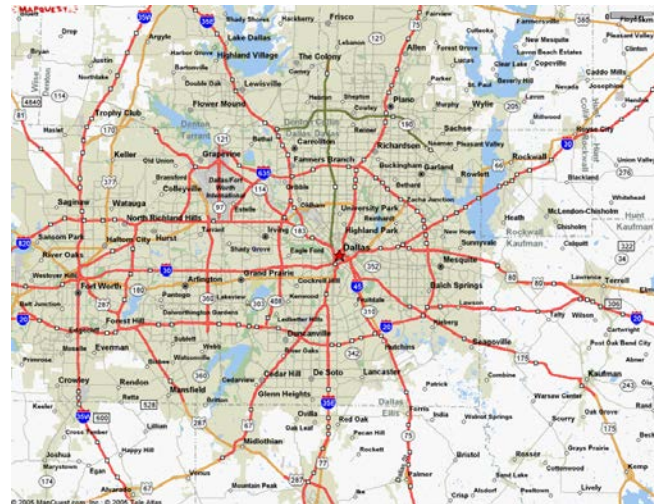
Transition FAQs

- **What happens to 9-1-1 trunk groups?**

  - 9-1-1 trunk groups from Communication Service Providers (ILECs, CLECs, WSPs, VSPs) to the Selective Routers will be replaced by 9-1-1 trunk groups into the ESInet.

  - These trunks will most likely be SS7 and CAMA terminating in Legacy Network Gateways, evolving to SIP (Session Initiation Protocol).

  - 9-1-1 trunk groups from the SR to the PSAP will be replaced by SIP trunks into IP-capable CPE or into Legacy PSAP Gateways (LPG).

Transition FAQs

- **Who can provide a "SIP Trunk"?**
  - A "SIP Trunk" is a high speed data circuit terminating in a router and utilizing the Session Initiated Protocol. Any Communications Service Provider can provide them.

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Paying for NG9-1-1

- PSAP Authorities must be allowed to **accrue funds** to build the new ESInets while still paying for and operating legacy networks

- Long term cost should be **comparable to or slightly higher than E9-1-1**, but NG9-1-1 service will offer additional features

- Consider **new funding** sources: IP access providers?
  - Access providers have a presence in your jurisdiction, whereas the VoIP providers (Skype, Vonage, etc) do not.

- Consider **new payment** terms for 9-1-1 fees
  - More accounts paying slightly lower fees.

- Determine how to **tax prepaid wireless sales.**

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Are Regulatory Changes Required?

Regulations should allow :

- Your NG9-1-1 provider to be different than your current E9-1-1 provider

- Your NG9-1-1 IP infrastructure provider to be different than your NG9-1-1 services provider

- New entrants to provide services

- We recommend:

  NENA NG9-1-1 Transition Policy Implementation Handbook. This document, prepared by the NENA Next Generation Partner Program (NGPP), addresses the legislative and regulatory barriers to implementation and provides a checklist for states to follow to ensure that necessary reforms are completed.

Are Regulatory Changes Required?

The National Emergency Number Association (NENA) document titled "Next Generation 9-1-1Transition Policy Implementation Handbook" states on page 10:

"... **Many existing laws, regulations and tariffs make specific reference to older technologies or system capabilities which may inadvertently inhibit the migration to NG9-1-1. To foster the rapid migration of NG9-1-1, it is essential that state and federal legislatures and regulatory bodies review current laws and regulations to keep pace with the rapidly changing public safety marketplace. Efforts should be designed to create a framework which will optimize 9-1-1 governing authority choices and establish a competitively neutral marketplace that allows 9-1-1 authorities to replace legacy 9-1-1 functions component by component."**

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Realistic Time Frames
(Without Massive Funding Intervention)

Implementation Start Dates

- Well funded early adopters -   2010-2012

- Most State-level programs -   2012-2015

- Rural, poorly funded areas -   2015-2020

- National Transition complete - 2021

- **TCS NG9-1-1 General Availability:**
  - **2Q 2011**

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Questions?

Thank You!

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Connections That Matter

Back Up Slides

Location/Subscriber Data Stores

Location Validation Function (LVF)

Uses GIS tables and optionally MSAG tables to determine valid locations for a 9-1-1 jurisdiction. The LVF data store is closely tied to the ECRF data store. Current valid locations for TCS' offering can be latitude/longitude, 9-1-1 jurisdiction address (MSAG address), and/or USPS-based address.

Location Information Server (LIS)

Stores location information for subscribers and/or access points. TCS' supports TNs, Subscriber URIs, or any unique string identifying a subscriber, device, or network entry point. Valid locations can be latitude/longitude, 9-1-1 jurisdiction address (MSAG address), and USPS-based addresses.

Subscriber Database (Additional Data in the earlier diagram)

Stores additional information related to the subscriber and/or to their service offering. Details include traditional ALI data, such as Class of Service, Type of Service, Company ID, disability indicator, as well as data new to 9-1-1, such as alternate phone numbers and emergency contacts.

Standard IP Network Elements

Border Control Function (BCF)

Provides security between public networks and the ESInet. Depending on the protocol and the security need the sub-function of the BCF can be served by a Session Border Controller, network firewall, or a software application.

Legacy Network Gateway (LNG)

A media gateway solution with additional 9-1-1 specific features that allows legacy, TDM-based carrier networks to access the emergency services available in the ESInet.

Legacy PSAP Gateway (LPG)

A media gateway solution with additional 9-1-1 specific features that allows legacy, TDM-based PSAP networks to access the emergency services available in the ESInet.

Protocol Interworking Function (PIF), Location Interworking Function (LIF), NG9-1-1 Interworking Function (NIF) subcomponents in both the LNG and LPG

The PIF provides protocol conversion to the PSTN. The LIF completes location requests using legacy methods. The NIF communicates to the ESInet using appropriate protocols.

Call Routing Systems

Emergency Services Routing Proxy (ESRP)

Receives SIP signaling. As needed, queries the LIS for location information, queries the ECRF for routing instructions, queries the PRF for applicable policy, and forwards the modified SIP signaling to the appropriate node.

Emergency Call Routing Function (ECRF)

Provides a destination URI based on the location associated with the subscriber, device, network entry point, or based on the location provided in call signaling. Current accepted location formats are latitude/longitude, 9-1-1 jurisdiction address (MSAG address), and USPS-based address. The system provides geo-based routing. TCS' system can also provide table-based routing if desired.

Policy Routing Function (PRF)

Provides "policy based" adjustments to the URI provided by the ECRF based on local preferences. TCS' overflow logic allows multiple PSAPs to be defined as alternates for a given PSAP. The current offering allows either a weighted primary then secondary overflow or a round robin to all defined secondary PSAPs.